CS112 - Fall 2022

Lab04

Instructor: Paul Haskell

READING

- Reading for this lecture: 3.1, 4.1-4.4 (but ignore UML)
- Reading for next lecture: 3.2, 3.3, 4.5

INTRODUCTION

This week you will develop programs in which you create your own class and in which use the `while()` and `if()` statements. We are starting to accumulate Java tools that will let you create more complicated and powerful programs.

Cubes

You will write a program called Cubes.java that will print the cubes of the integers starting with 1 and increasing. The program should only print the values of the cubes (not the original numbers), and should not print any values greater than or equal to 2000. Your output should look like:

1
8
27
etc

Collatz Conjecture[1]

Ok, on to some serious math. There is a mathematical conjecture (something that people think is true but cannot prove) that says "Pick any positive integer. If the number is even, replace it with x/2. If it is odd, replace it with 3x + 1. Keep repeating that process until your number equals 1." The conjecture says all positive integers eventually converge to 1.

Your program **Collatz.java** should run the recipe above for the integers from 1 through 200, keeping track of the number of "steps" required (either dividing by 2 or replacing with 3x + 1) until the result equals 1. Print out a table that lists each number and its required number of steps.

- 1 needs 0 steps
- 2 needs 1 step

So your output should look like:

1 0
2 1
3 7
etc

[1] Taken from *Fundamentals of Java Programming,* Mitsunori Ogihara, Springer Press.

Spheres

In your program **SphereInfo.java**, you will write your own class, called `class Sphere`. (There should also be a `class SphereInfo` that has your main() function.) The `Sphere` class should have a member variable called `diameter`. It shall have several methods:

- `setDiameter(double) // sets the diameter, of course!`
- `radius() // returns the radius`
- `diameter() // returns the diameter`
- `surfaceArea() // returns the surface area of the sphere`
- `volume() // returns the volume of the sphere`

Create three objects of type Sphere and set their diameters to 0.0, 1.0, and 7.5, respectively. Use these objects to print the following output, using `System.out.println()`:

> **A sphere of radius 0.0 has surface area <<fill in proper answer>> and volume <<fill in proper answer>>**
>
> **A sphere of radius 0.5 has surface area <<fill in proper answer>> and volume <<fill in proper answer>>**
>
> **A sphere of radius 3.75 has surface area <<fill in proper answer>> and volume <<fill in proper answer>>**

Reminder

Put useful comments into your code. Design and organize your code so that it is easy for others to understand.

Put your programs into a subdirectory called **Lab04** inside your **MyWork** directory, and remember to push your **Lab04** to GitHub before the deadline. This assignment must be turned in before 11:59pm on Monday Sept 12th.

Conclusion

In this lab you created Java programs that included your own class definitions. And you used "control statements" to manage how many times statements run.

Rubric

Cubes.java is worth 5 points:

- One point if it has the correct name, is located in the correct directory, and compiles
- Four points if the output is correct

Collatz.java is worth 10 points:

- Two points for each of 5 cases that we will verify from your program output

SphereInfo.java is worth 20 points:

- 12 points: 4 points for correct results for each of the three spheres.
- 0-8 points, based on the graders' judgment of the software design quality, software readability, comments, etc.